

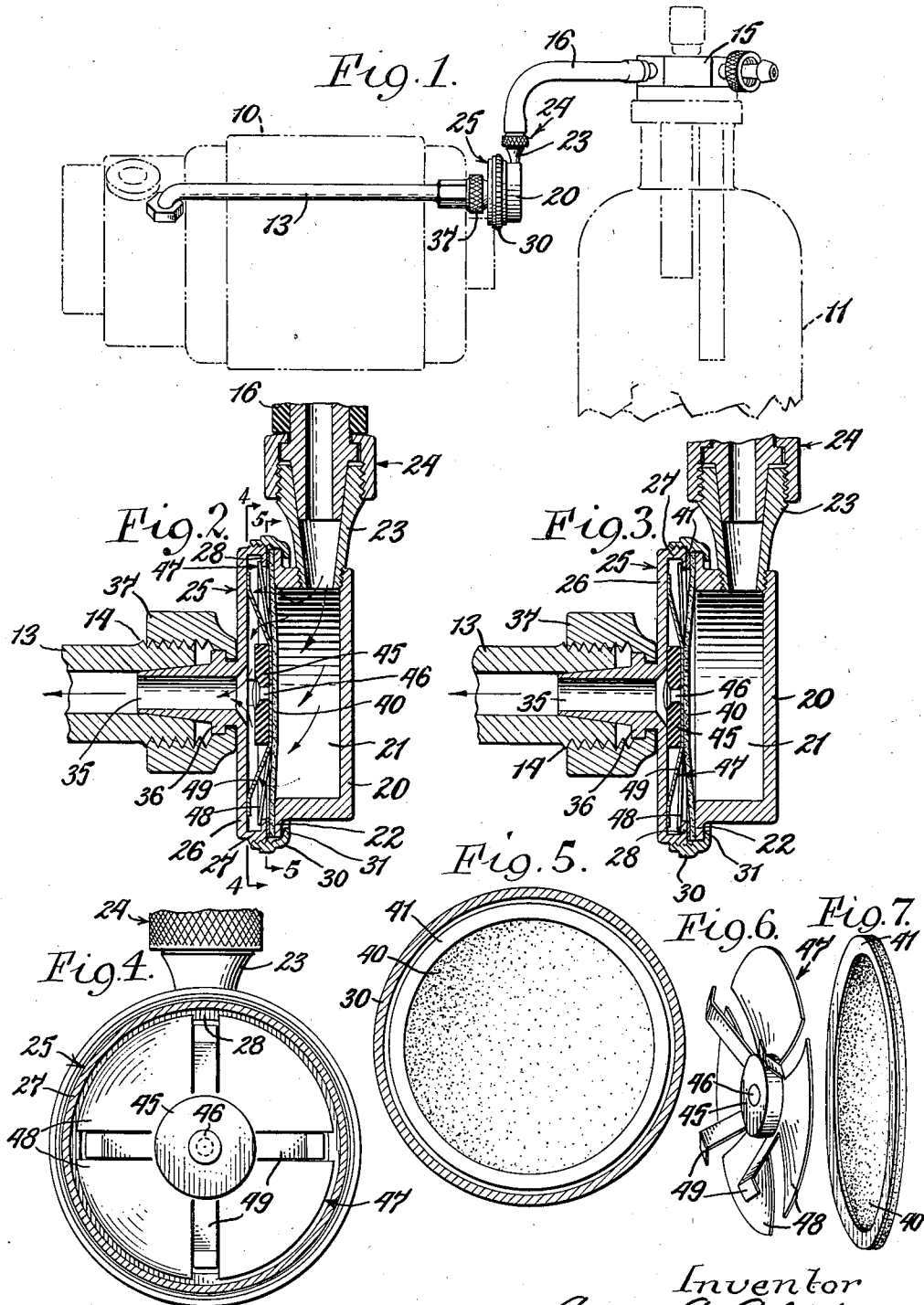
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VALVE FOR AUTOMATICALLY PREVENTING THE PASSAGE OF LIQUID

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VALVE FOR AUTOMATICALLY PREVENTING
THE PASSAGE OF LIQUID

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This invention relates to a valve for automatically preventing the passage of liquid and more particularly to an overflow valve for use between a suction bottle and the vacuum pump to prevent the pump from flooding when the suction bottle is accidentally overfilled. Such suction bottles are principally used by operating surgeons in removing blood or mucus from the patient.

For years surgeons and attendants operating rotary pumps for exhausting vacuum bottles into which blood or mucus of patients is drawn, have been beset with the problem of inconvenience and trouble when the suction bottle was accidentally overfilled. When such occurs blood or mucus is drawn into the pump, requiring the pump to be dismantled and cleaned.

It is the principal object of the present invention to provide a valve on the suction side of the pump which positively will not permit blood or mucus to enter the pump.

Another object of the invention is to provide such a valve which is simple in construction and reliable in operation and can readily be attached to any conventional suction pump regardless of its age or model.

Another object is to provide such a valve which will not in any way interfere with the normal functioning of the pump in maintaining a vacuum within the vacuum bottle.

Another object of the invention is to provide such a valve which can readily be completely removed and the pump directly connected to the tube leading to the vacuum bottle. Thus, in the event the vacuum bottle is accidentally overfilled so as to cause the valve to close the line leading to the pump and there is insufficient time to place the valve in operative condition, the operator merely removes the valve and couples the vacuum bottle directly with the pump so as to enable the continued operation of the pump and suction bottle.

Another purpose is to provide such an overflow which will not interfere with the continued running of the pump to provide ether vapor to the patient and at the same time prevents any fluid from being carried from the suction bottle to the pump.

In the accompanying drawing:

Fig. 1 is a side elevation of the valve embodying my invention showing the same coupled to the inlet line of a rotary pump and to the rubber tube leading to a suction bottle.

Fig. 2 is a vertical section through the overflow valve and its connections showing the normal po-

sition of its parts in maintaining a vacuum in the suction bottle.

Fig. 3 is a view similar to Fig. 2 showing the position of the parts when the suction bottle has been overfilled and blood, water or mucus has entered the valve, the valve being thereby closed to prevent such blood, mucus or water from entering the pump inlet line.

Figs. 4 and 5 are vertical transverse sections, taken on the correspondingly numbered lines on Fig. 2.

Fig. 6 is a perspective view of the spring disk which carries the rubber valve head.

Fig. 7 is a perspective view of the chamois disk which functions, when moist, to effect a closure of the valve.

The overflow valve embodying my invention is primarily intended for use in the line between a rotary motor driven vacuum pump 10 and a suction bottle 11 to prevent blood or mucus from entering the rotary pump 10 when the suction bottle is overfilled. These may be of any conventional construction and hence are illustrated by broken lines.

The pump 10 is provided with the usual inlet line 13, the inlet enlarged end of which is threaded, as indicated at 14, this enlarged end also preferably being of hexagonal form. The suction bottle carries the usual valved cap 15 having suitable tubes extending into the bottle, through one of which air is exhausted through a rubber tube 16 and through the other of which the blood or mucus is drawn into the bottle by the suction maintained therein.

The overflow valve is shown as comprising a cup-shaped body 20 forming an inlet chamber 21, the rim of this cup-shaped body 20 being provided with an outwardly extending annular flange 22 and forming with the rim a flat circular face at the open side of the body. A nipple 23 is screwed into a threaded opening at one side of the cup-shaped body 20, this nipple being externally threaded to receive a coupling indicated generally at 24 and secured to the end of the rubber tube 16. The coupling 24 can be of any usual and well known form.

The valve body 20 is closed by a cap 25 having a flat circular wall 26, an externally threaded rim 27 and an annular flange 28 projecting inwardly from the edge of the externally threaded rim 27. The cap 25 is secured to the body 20 by a coupling ring 30, this coupling ring being internally threaded at one side to screw onto the threads of the rim 25 and being provided at its opposite side with an inwardly extending annu-

lar flange 31 adapted to engage the outside of the flange 22 of the body 20. It will be seen that upon tightening the ring 30 the cap 25 is securely fastened to the body 20 of the valve.

The cap 25 is formed to provide an axial outwardly extending nipple 35 which is preferably tapered to fit into the tube 13. To couple this nipple and tube the nipple is provided with a flange 36 rotatably carrying an internally threaded coupling collar 37, this collar screwing on the threads 14 and holding the nipple 35 in sealed engagement with the interior of the tube 13.

Arranged in the valve housing is a valve head adapted to seat against the cap 25 around the opening through its outlet nipple 35, this valve head being yieldingly held in an unseated position and being adapted to be seated by the movement of a moisture sensitive element when this moisture sensitive element is moist. The moisture sensitive element is in the form of a disk 40 which is in the form of a porous diaphragm, the pores permitting the relatively free passage of air through the diaphragm but resisting the passage of air when filled with moisture. I have found that a diaphragm made of chamois is suitable for this purpose, the chamois disk being preferably secured at its edge to a metal ring 41 which holds the diaphragm in flat circular form for ease in replacement in the valve housing. This metal ring and the edge of the chamois disk 40 are securely clamped between the flanges 22 and 28 of the body 20 and the cover 25. It is therefore apparent that the chamois diaphragm 40 extends completely across the valve body and that the air drawn from the suction bottle 11 by the pump 10 must pass through this diaphragm.

The valve head 45 is in the form of a rubber disk which is shown as secured by a rivet 46 to the center of a metal carrying member, indicated generally at 47. This carrying member is of circular form and is shown as having four dished segments 48 which rest against the flange 28 of the cover 25, as best shown in Figs. 2-4. The metal form between the several segments 48 is formed to provide four spring fingers 49, these fingers extending axially toward the cover 25 and engaging its inner face, as best illustrated in Figs. 2 and 3. These spring fingers yieldingly hold the rubber valve head 45 out of engagement with the inner face of the cover 25 but are capable of being flexed to permit this valve head to seat around the outlet opening in the cover 25 and hence prevent the passage of all fluid, either gas or liquid, through the valve. The segments 48 are dished in the manner shown so that the chamois diaphragm 40 is normally in contact with the carrying member 47, as best illustrated in Fig. 2, thereby to render the valve sensitive in operation.

In operation the valve is placed in the line between the suction bottle 11 and the rotary pump 10 and the motor started so as to exhaust the suction bottle. Blood or mucus from the patient is drawn into the suction bottle, and the vacuum in this suction bottle is maintained by the pump, the air passing through the tube 16 into the inlet chamber 21 of the valve body, through the pores of the chamois diaphragm 40, through the spaces between the dished segments 48 of the carrying member and around the open rubber valve head 45 into the nipple 35 and thence into the inlet line 13 of the pump. During this operation the spring fingers 49 yieldingly hold the rubber valve head 45 unseated, as illustrated in Fig. 2.

In the event that the suction bottle 11 is acci-

dentally overfilled, the blood or mucus is drawn into the rubber tube 16 and thence into the inlet chamber 21 of the valve body. This liquid is sucked against the chamois diaphragm 40 so as to fill its pores and greatly increase the resistance of this diaphragm to the passage of all fluid. As a result the suction of the pump 10 draws the chamois diaphragm 40 toward the cap 25 against the resistance of the spring fingers 49. This movement of the diaphragm flexes the metal member 47 carrying the rubber valve head 45 and moves this valve head into engagement with the inner face of the cap 25. As this rubber valve head is aligned with the outlet opening in the cap 25 it will be seen that all further passage of fluid through the valve is prevented. Once the rubber valve head 45 is closed, it is, of course, held closed by the suction of the pump. In the event, therefore, of the valve closing because of the overfilling of the suction bottle 11, it is desirable to remove the overflow valve while the pump is still running so that there will be no danger of a few drops of liquid entering the pump inlet line 13 as might be the case if the pump 10 were stopped before the valve is removed.

In the event that the suction bottle 11 does overfill and the overflow valve closed, as above described, there need be no substantial interruption in the performance of the apparatus, it being merely necessary to unscrew the valve from the pump inlet line 13 and connect an empty suction bottle directly with this line. In this connection it will be noted that the threads of the coupling 24 of the suction bottle tube 16 are of the same size as the threads 14 of the pump inlet line 13.

Before the overflow valve is replaced the chamois disk 40 must be renewed and the tube 16 and cap 15 of the suction bottle thoroughly dried. This is important as moisture which may be left in these parts will cause the valve with its renewed chamois disk to close again. In removing the chamois disk, the spring carrier disk 47 should not be removed as it may be damaged by handling. The entire valve can be rinsed in tepid water for cleansing and dried with a slight amount of warmth if necessary. If properly handled, no liquid will penetrate that part of the valve body which contains the spring carrying member 47.

From the foregoing it will be seen that the present invention provides an overflow valve which automatically prevents the passage of liquid, thereby being particularly applicable in the line between a suction bottle and a suction pump, as above described, to prevent the pump from being flooded with blood or mucus should the suction bottle be overfilled. It will also be seen that the valve is entirely certain of operation and simple in construction and is so constructed as to be readily cut out of the line if there is insufficient time to renew the chamois diaphragm.

I claim as my invention:

1. A valve for automatically preventing the passage of liquid, comprising a valve body, valve means arranged in said body and adapted to be closed to prevent the passage of fluid there-through, a movable porous member arranged in said valve body and extending across the passage therethrough, the fluid passing through said body being compelled to pass through said porous member, the pores of said porous member being of such size as to be clogged by moisture admitted to said valve body, thereby to effect a movement of said porous body by the fluid passing through said valve body, and means responsive to the

movement of said porous member for closing said valve means.

2. A valve for automatically preventing the passage of liquid, comprising a valve housing, valve means arranged in said housing and adapted to be closed to prevent the passage of fluid therethrough, a porous flexible diaphragm in said valve body and extending across the interior thereof and through which the fluid passing through said body is required to pass, the pores of said porous diaphragm being of such size as to be filled by moisture entering the valve body, thereby to effect movement of said diaphragm by the fluid passing through said valve body, and means responsive to the movement of said diaphragm for closing said valve means.

3. A valve for automatically preventing the passage of liquid, comprising a valve body, valve means arranged in said valve body and adapted to be closed to prevent the passage of fluid therethrough, a chamois diaphragm arranged in said valve body and extending across the interior thereof and through which the fluid passing through said valve body is required to pass, and means responsive to the movement of said chamois diaphragm when moistened to close said valve means.

4. A valve for automatically preventing the passage of liquid, comprising a valve body provided with a seat around its outlet port, a porous diaphragm arranged in said valve body and extending across the interior thereof and through which the fluid passing through said valve body is required to pass, a spring member arranged in said valve body adjacent said diaphragm, and a valve head carried by said spring member and arranged to engage said seat and normally held out of engagement with said seat by said spring member, said spring member being moved in response to the movement of said diaphragm when moistened to move said valve head into engagement with said seat.

5. A valve for automatically preventing the passage of liquid, comprising a valve body provided with a seat around its outlet port, a porous diaphragm arranged in said valve body and extending across the interior thereof and through which the fluid passing through said valve body is required to pass, a spring member arranged in said valve body in contact with said diaphragm, and a valve head carried by said spring member and arranged to engage said seat and normally held out of engagement with said seat by said spring member, said spring member being moved in response to the movement of said diaphragm when moistened to move said valve head into engagement with said seat.

6. A valve for automatically preventing the passage of liquid, comprising a cup-shaped valve body having an inlet port, a cap closing said cup-shaped valve body and having an outlet port, and a valve seat surrounding said port, a porous diaphragm having its edges secured between the rims of said cup-shaped body and cap and through which the fluid passing through said valve body is required to pass, a flat spring member arranged in said cap and arranged to engage said diaphragm, and a valve head carried by said spring member and arranged to engage said seat, said spring member normally holding said valve head out of engagement with said seat, said spring member being moved in response to the movement of said diaphragm when moistened to

move said valve head into engagement with said seat.

7. A valve for automatically preventing the passage of liquid, comprising a circular cup-shaped valve body having an inlet port, a circular cap secured to the rim of said valve body and having an axial outlet port surrounded by an internal valve seat, a circular porous diaphragm secured at its edges between the rim of said body member and said cap and through which the fluid passing through said valve body is required to pass, a spring member engaging the center of said diaphragm and having a plurality of radiating spring fingers engaging the inner face of said cap, and a valve head secured to the center of said spring member and arranged to engage said valve seat, said valve head being normally held unseated by said spring fingers and said valve head being seated through motion derived from the movement of said diaphragm by the fluid passing through said diaphragm when said diaphragm is moistened.

8. A valve for automatically preventing the passage of liquid, comprising a circular cup-shaped valve body having an inlet port and having a radially outwardly projecting flange at its rim, a circular cap having an externally threaded rim and having an annular flange projecting inwardly from said rim, said cap also being provided with an axial outlet port surrounded by an internal valve seat, a threaded coupling ring engaging the threads of said cap and formed to secure said valve body and cap together, a circular porous diaphragm having its rim secured between the flanges of said body member and cap whereby the fluid passing through the valve is required to pass through said diaphragm, a metal disk having a plurality of segments engaging the inwardly projecting flange on the rim of said cap and having between said segments a plurality of radially extending spring fingers arranged to engage the internal face of said cap opposite its flange, and a valve head secured to the center of said metal disk and arranged to engage said seat, said valve head being normally held unseated by said spring fingers and being moved by the movement of the diaphragm when moistened under the influence of the fluid passing therethrough to engage said seat and prevent the passage of said fluid through said outlet port.

9. A valve for automatically preventing the passage of liquid, comprising a valve body having an inlet and having an outlet surrounded by a valve seat facing the interior of said valve body, a valve head arranged in said body and movable into sealing engagement with said valve seat to prevent the escape of fluid through said outlet, spring means arranged in said body between said inlet and said outlet and connecting said valve head with said body and yieldingly holding said valve head away from said seat, a movable moisture sensitive member arranged in said body between said inlet and said outlet and obstructing the flow of fluid through said body when moistened whereby said moisture sensitive member, when moistened, is moved toward said seat by the fluid passing through said valve body, and means operatively connecting said moisture sensitive member and said valve head to move said valve head into engagement with said seat when said moisture sensitive member is so moved toward said seat.

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